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AUTHOR	Cooper, Samuel
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ABSTRACT

An instructor's manual and student activity guide on seed germination are provided in this set of prevocational education materials which focuses on the vocational area of agriculture. (This set of materials is one of ninety-two prevocational education sets arranged around a cluster of seven vocational offerings: agriculture, home economics, distributive education, health occupations, world of work, trade and industry, and office occupations.) The instructor's guide is organized into the following elements: title of activity, duration of activity (six to seven class periods not including 30 days of monitoring plants and totaling data), activity goals, eight instructional objectives, related vocational clusters, and activity implementation (description, materials needed, safety considerations, teacher preparation prior to class, during the class, follow-up activities, answer key to student check point activities, and masters for duplication [e.g., student answer sheet, plant growth chart]). The student activity guide provides step-by-step instructions (narrative and illustrations) for completing each instructional objective (e.g., list five ways seeds benefit humans, plant two seeds, maintain growing plants). At the end of each set of instructions is a student check point (evaluation activity). Six occupational descriptions (e.g., vegetable farmer, farmworker, harvest worker) conclude the document. (JH)

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AGRICULTURE

AGRICULTURAL SCIENCE - SEED GERMINATION

Kit No. 51

INSTRUCTOR'S MANUAL

Prepared by

Mr. Samuel Cooper
Cross High School
Cross, South Carolina 29436

State Department of Education
Office of Vocational Education
Prevocational Education
Columbia, South Carolina 29201

In Cooperation With

Vocational Education Media Center
Clemson University
Clemson, South Carolina 29631

1978

CE 020 525

U.S. DEPARTMENT OF HEALTH
EDUCATION & WELFARE
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TITLE OF ACTIVITY

Kit No. 51, Agriculture - Agricultural Science, Seed Germination

DURATION

Main Activity – 4 class periods
Followed by 30 days of monitoring plants and totaling data
Follow-up Activity – 2 to 3 class periods

GOALS

The purpose of this activity is to introduce students to the processes involved in seed germination and to familiarize them with the manner in which seeds sustain life through the process of germination. Students will learn how important seeds are to humans and animals.

INSTRUCTIONAL OBJECTIVES

This student will list five ways in which seeds benefit humans.

The student will identify the parts of a germinated plant.

The student will prepare the soil for planting.

The student will prepare four paper cups with soil for planting.

The student will choose the variety of seed to plant.

The student will plant two seeds in each of the numbered cups.

The student will maintain the germinating (growing) plants.

After thirty (30) days, the class will determine which soil mixture was best for a particular seed.

VOCATIONAL CLUSTERS

Office Occupations

ACTIVITY IMPLEMENTATION

A. Description

This activity is designed to show how people benefit from crop production. In order to produce hardy, productive crops, fertilizer is usually added to the soil. In this activity, students will actually experiment with various types of chemical fertilizers and record their findings. The students will keep records for 30 days after planting, tally the results on a tally sheet, and discuss the results.

B. Safety

Students should wash their hands after contact with any chemical fertilizer.

C. Materials Required

1. Audio Visual Equipment
   None
2. Technical Equipment
   4 mixing trays
   4 hand trowels
   4 measuring spoons (1 tsp. – 5 ml)
   4 sprinkler heads
   3 one-gallon cans (3.8 l)
3. Expendable Materials
   (per 25 students)
   100 paper cups, 6 - 8 oz size (170.1 g - 226.8 g)
   6 lbs. (2.7 kg) redi-mix earth or soil
   2 lbs. perlite (.9 kg)
   1 lb. 5-5-5 fertilizer (.45 kg)
   1 lb. 10-10-10 fertilizer (.45 kg)
   1 lb. ammonium nitrate (.45 kg)
   4 empty soda bottles (any size)
   Seeds (8 per student, one variety only OR ¼ lb. (.113 kg) of each variety
   Snap beans
   Pole beans
   Lima beans
   Beets
   Carrots
   Garden peas
   Radishes
   Sweet corn
   Watermelon
   Cantaloupe
   These seeds can be purchased at a hardware or feed & seed store.
   1 roll masking tape

D. Preparation Prior to Class

Purchase soil, seed, perlite, and cups.

Reproduce Masters for Duplication. Be sure you have enough copies for class.

Set-up work areas in your room for soil mixing and plant storage.

Review the Student Learning Activity Guide.

E. During Class Session

Use the brief introduction found in the activity implementation.

Distribute the programmed texts. Instruct them NOT to write in the activity guide.

Distribute the Student Answer Sheets. Tell them these will be collected after the activity is over as a record of their progress.

After the students have prepared the soil, make sure they clean up their work area.

Observe students and assist them when necessary. You may permit faster students to aid the slower ones.

When all students have planted their seeds, have them return all materials to proper place.

Have each student plant two seeds. If one seed is damaged, the odds are the other will germinate.

After the seeds are planted, allow five minutes each day for student to monitor and keep records on the plants.

Give students the growth chart.

After thirty-four (34) days, distribute tally sheets to students. Call upon each student to state the type crop planted, the progress of each, and type fertilizer used.

F. Follow-up Activities

1. Have students fill out VIEW Fact Sheet.
2. Group Activity: Discuss results of experiment. Pose some problems related to farming; could they be solved by crop management?
3. Invite a county agent to discuss fertilization and crop production in your area.

ANSWER KEY

Objective I

1. Provide oxygen
2. Food for humans
3. Food for animals
4. Processed foods
5. Manufactured items

Objective II

1. B
2. D
3. E
4. A
5. C

Objective III

White

Objective IV

1. soil
2. soil and one teaspoon of 5-5-5
3. soil and one teaspoon of 10-10-10
4. soil and ammonium nitrate

MASTERS FOR DUPLICATION

VIEW Fact Sheet
Student Answer Sheet
Official Growth Chart
Tally Sheet

VIEW FACT SHEET

NAME _____ CLASS _____ OCCUPATION _____

A. List the advantages (good points) of this occupation (job).

B. List the disadvantages (bad points) of this occupation (job).

C. List three things you should know to do this occupation (job).
1.
2.
3.

D. What type of education should you get to be prepared (do) for this occupation (job)?

E. What courses must you take to go into this occupation (job)?

F. What do you think your future in this occupation (job) will be?

G. What wage can you expect in this occupation (job)?

H. What are the working hours of this occupation (job)?

I. To learn more about this occupation (job), write to:

J. Using a scale of 1 to 5, circle the number that measures your interest in this occupation (job) as a possible career.

I don't like it. ← 1 2 3 4 5 → I like it.

STUDENT ANSWER SHEET

INSTRUCTIONAL OBJECTIVE I

List five (5) ways seeds or plants benefit humans.

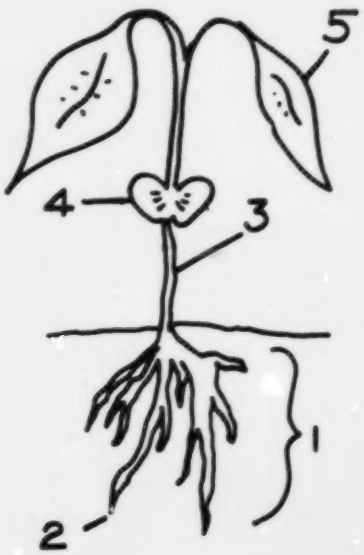
1.

2.

3.

4.

5.



INSTRUCTIONAL OBJECTIVE II

_____1.	A.	Cotyledons
_____2.	B.	Root system
_____3.	C.	True leaves
_____4.	D.	Root hairs
_____5.	E.	Stem

INSTRUCTIONAL OBJECTIVE III

What color is perlite? _____

INSTRUCTIONAL OBJECTIVE IV

What ingredients are in the following cups?

No. 1 – _____

No. 2 – _____

No. 3 – _____

No. 4 – _____

INSTRUCTIONAL OBJECTIVE V

What seed did you choose? _____

OFFICIAL GROWTH CHART

Crop: _____

Farmer: _____

INSTRUCTIONAL OBJECTIVE VII

| | | |

TALLY SHEET

INSTRUCTIONAL OBJECTIVE VIII

SEED	NO FERTILIZER	5-5-5	10-10-10	Ammonium Nitr.
Beans, Snap				
Beans, Pole				
Beans, Lima				
Beets				
Cantaloupes				
Carrots				
Peas, Garden				
Radishes				
Sweet Corn				
Watermelon				

AGRICULTURE
AGRICULTURE SCIENCE - SEED GERMINATION

Kit No. 51

STUDENT
LEARNING ACTIVITY GUIDE

Prepared by

Mr. Samuel Cooper
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INTRODUCTION

For the next few days we will be studying seed germination. Seeds serve as food for humans and animals and they provide raw materials from which many manufactured products are made. In addition, survival of a plant is made possible through its seeds which germinate under the proper conditions and grow into new plants.

GOALS

The purpose of this activity is to introduce students to the processes involved in seed germination and to familiarize them with the manner in which seeds sustain life throughout the germination process.

Students will also learn how important seeds are to humans and animals.

DIRECTIONS

This activity involves the use of soil, water, fertilizer, and seeds. Because of the mixing and planting process, this activity may become a problem if neatness and orderliness are neglected. Follow all objectives and steps as accurately as possible.

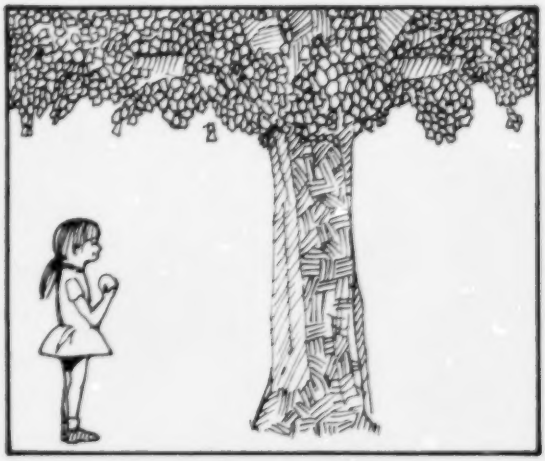
MATERIALS

The instructor will distribute the necessary materials.

PROGRAMMED TEXT

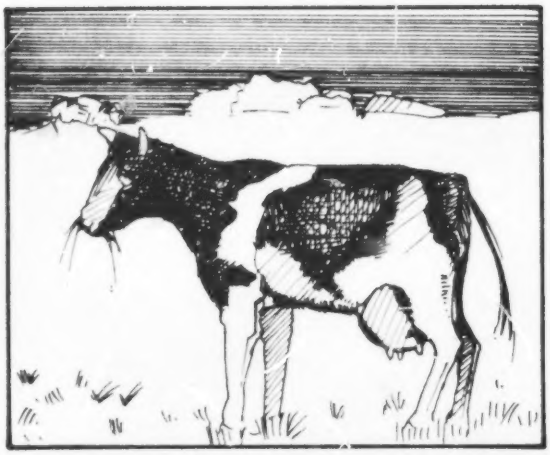
Instructional Objective 1

The student will list five (5) ways seeds benefit humans.



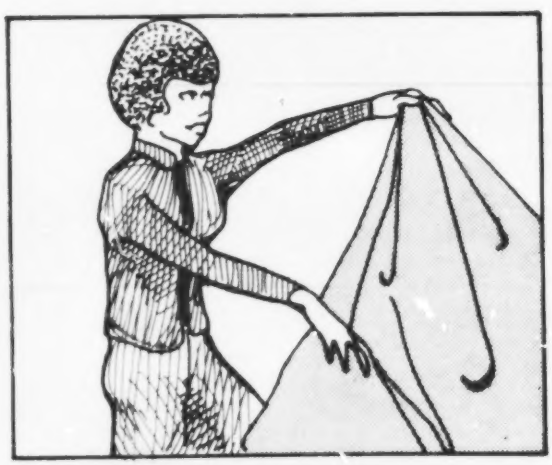
STEP 1 – Seeds grow into plants which, through photosynthesis, (a process of changing carbon dioxide to oxygen), create a healthy environment for all of us.

STEP 2 – Seeds are used as food for humans.



STEP 3 – Seeds are also food for animals which serve human needs.

STEP 4 – Seeds can be processed into many foods; for example, bread or soybean milk.



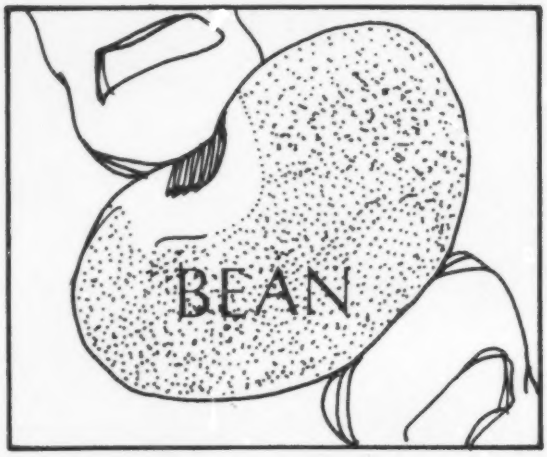
STEP 5 – Seeds and seed products can be converted into manufactured items such as cotton cloth.

Check Point

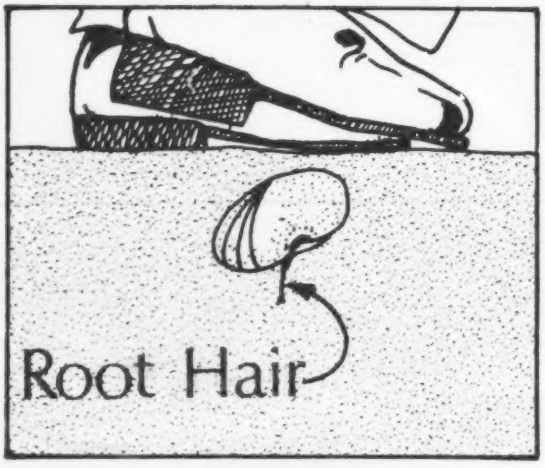
On your student answer sheet, list five ways seeds benefit humans.

Instructional Objective II

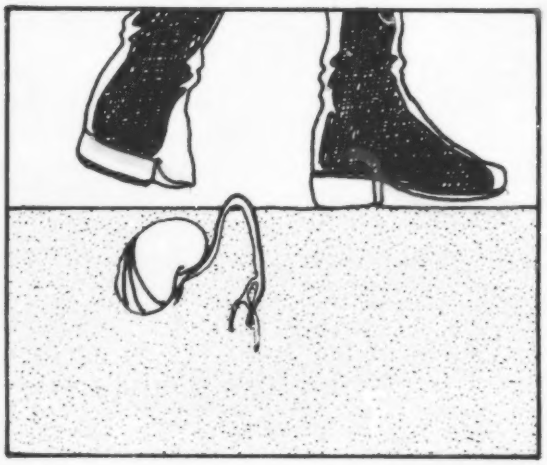
The student will identify the parts of a germinated plant.



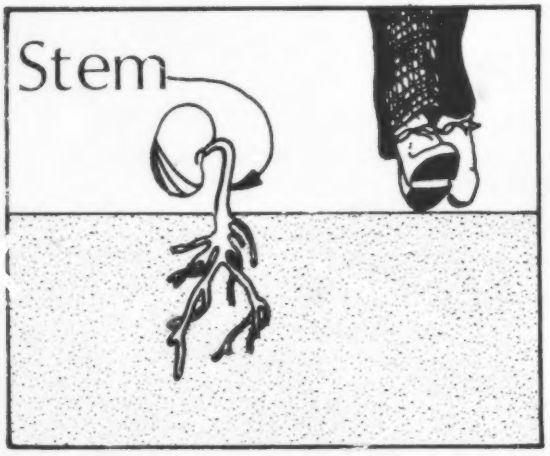
STEP 1 – Seeds, like all living plants, must establish a life support system.



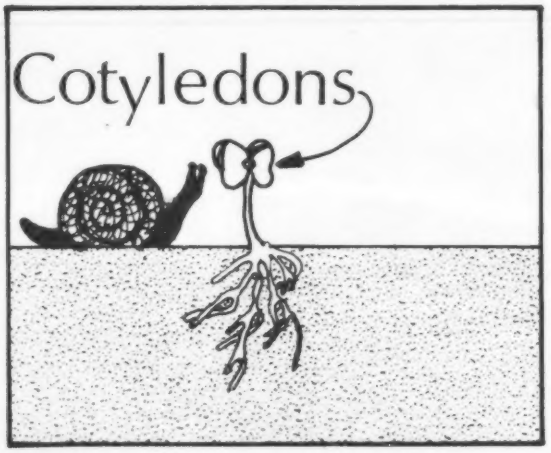
STEP 2 – When a bean seed begins to germinate, a small root hair will establish the beginning of an underground root system.



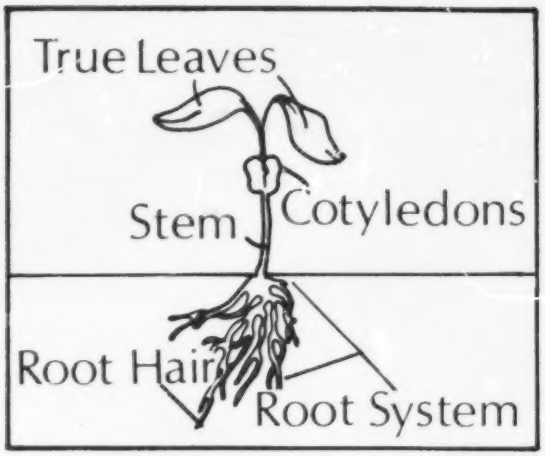
STEP 3 – With this root serving as an anchor and supplying food for growth, the plant will break through the soil.



STEP 4 – In the next stage of growth, the young stem will try to raise the original seed *(cotyledon)* to a vertical position.



STEP 5 – The cotyledon (seed) will split to form a leaf system.



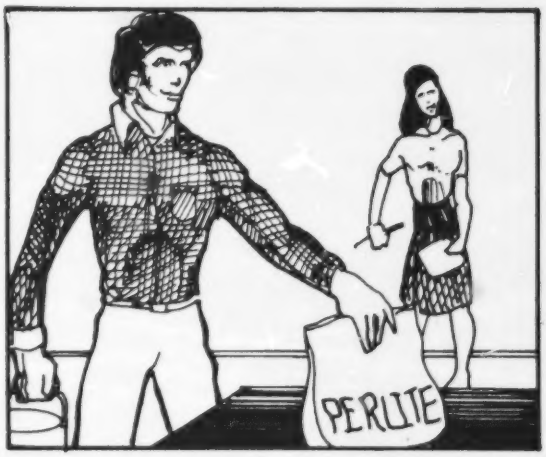
STEP 6 – After the cotyledons have opened, the first true leaves will appear. These six steps list the growth pattern of a seed.

Check Point

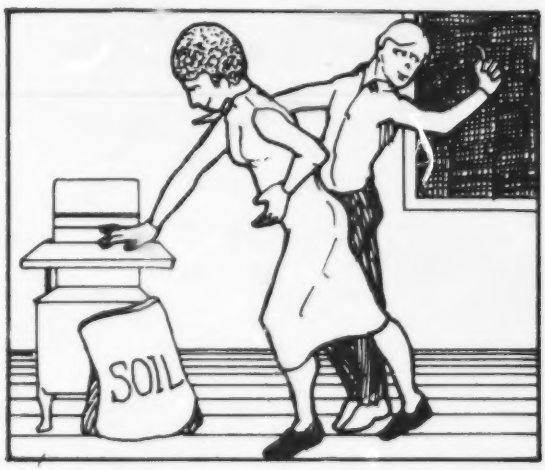
Using the diagram in your Student Answer Sheet, identify the parts of a young plant.

Instructional Objective III

The student will prepare soil for planting.



STEP 1 – Take a gallon (3.79 l) can and find the perlite (it's white).



STEP 2 – Now find the redi-mix or soil.

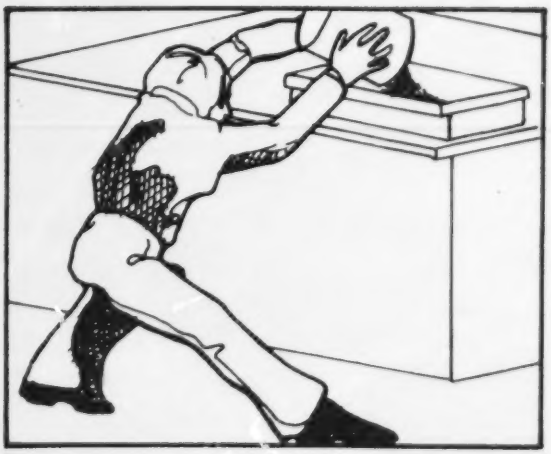
Check Point

On your Student Answer Sheet, identify the perlite.

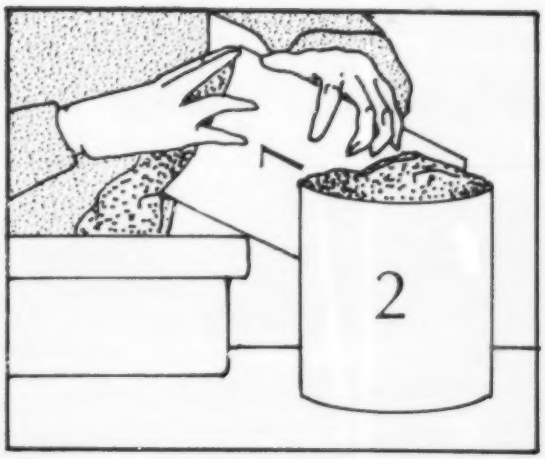
STEP 3 – Fill the one-gallon (3.79 l) can to the top with the redi-mix or soil.

Check Point

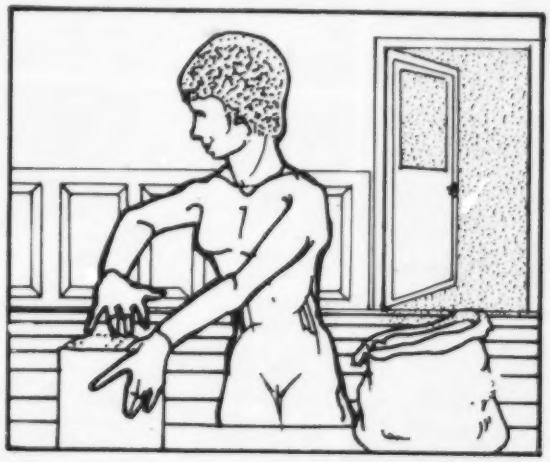
Is the gallon (3.79 l) can filled to the top?



STEP 4 – Empty the can of soil into a large mixing tray (five-gallon size – 18.9 l)

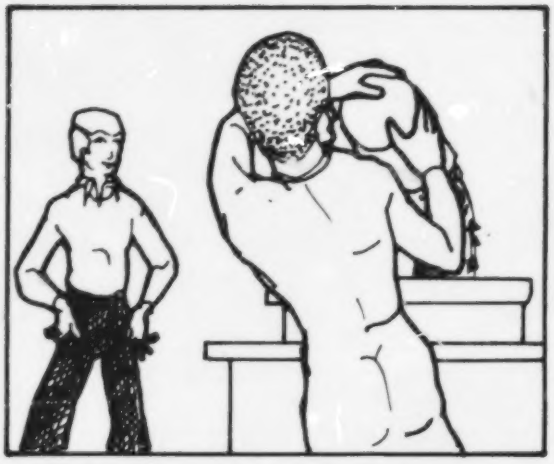


STEP 5 – Measure two more gallons of soil and empty into the large container. (7.6 l)

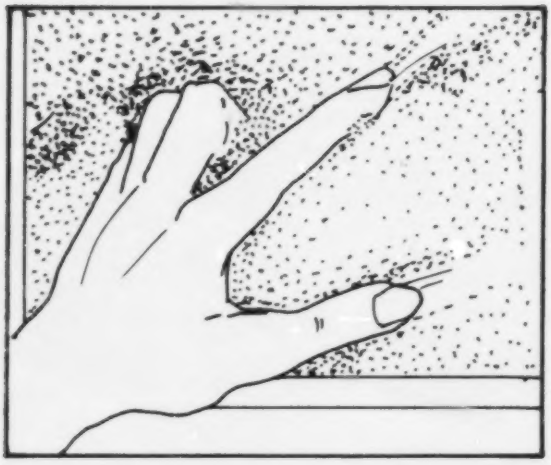


Check Point

At this point, you should have emptied the gallon can (3.79 l) a total of three times. If you have not, start measuring again.



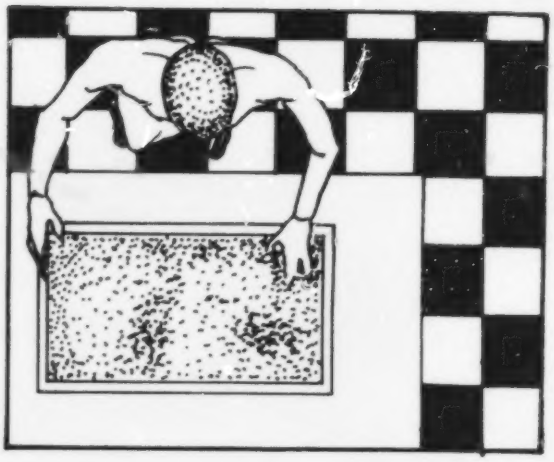
STEP 6 – Fill the one-gallon (3.79 l) can to the top with perlite.



STEP 7 – Empty the perlite into the same container holding the soil.

Check Point

Do you have three gallons (11.4 l) of soil and one gallon of perlite in the same container? If so, proceed to Step 8.



STEP 8 – Now mix the soil and perlite with your hands or a stick.

STEP 9 – Stir ingredients until they are evenly mixed.

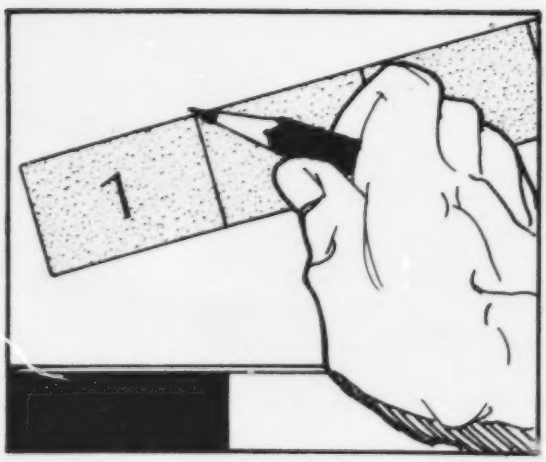
Check Point

Are there large patches of soil or perlite on the bottom or top? If so, continue to mix.

Instructional Objective IV

The student will prepare four paper cups for planting.

STEP 1 – Obtain four cups from your instructor.



STEP 2 – Using either a pencil or a ball point pen, mark the numbers 1 - 4 on four (4) inches (5.08 cm) of masking tape.

STEP 3 – Place a number on each cup.

STEP 4 – Locate the three bags of fertilizer.

STEP 5 – The first bag is 5-5-5 fertilizer.

STEP 6 – The second bag is 10-10-10 fertilizer.

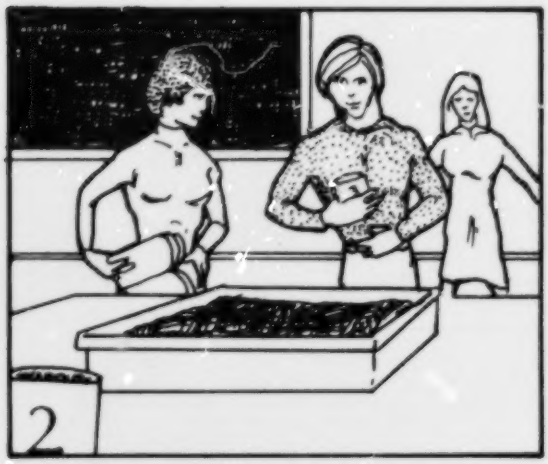
STEP 9 – Fill cup number two one-half full of soil mixture.

STEP 7 – The third bag is ammonium nitrate.

STEP 10 – Add to cup number two (2) one teaspoon of 5-5-5 fertilizer; mix well.

STEP 8 – Fill cup number one with soil mixture.

STEP 11 – Add enough soil mixture to fill cup two. Mix well.



STEP 12 – Follow steps 9, 10, and 11 for cup number three (3) (except add one teaspoon of 10-10-10 fertilizer rather than 5-5-5).

STEP 13 – Follow steps 9, 10, and 11 for cup four (4) (except add one teaspoon of ammonium nitrate rather than 5-5-5).

Check Point

Are the four cups filled and mixed well?

Use Student Answer Sheet to answer Instructional Objective IV, checkpoint.

Instructional Objective V

The student will choose the variety of seed to plant.

STEP 1 – In vegetable farming, a farmer may choose one crop over another because of its rapid growth, high profits, or market demand. You may choose the variety of seed you would like to transplant in your own garden.

PLANTING CHART

VEGETABLE	PLANTING DATES Spring	Fall	PLANTING DEPTH (inches)	APPROXIMATE DAYS TO HARVEST
Beans, Snap**	Apr. 15-30	Aug. 1-15	1" (2.54 cm)	50-60
Beans, Pole	Apr. 15-30	July 15-25	1 (2.54 cm)	60-70
Beans, Lima	May 1-15	July 1-15	1½ (3.81 cm)	65-75
Beets	March 1-30	Aug. 1-30	¾ (1.90 cm)	50-60
Cantaloupes	April 15-May 15	June 15-30	1 (2.54 cm)	75-85
Carrots	March 1-15	Aug. 1-30	¼ (.63 cm)	60-70
Peas, Garden	Feb. 1-15	–	1½ (3.81 cm)	65-80
Radish**	Feb. 15-Mar. 15	Sept. 1-30	½ (1.27 cm)	25-30
Sweet Corn**	Apr. 15-30	–	1 (2.54 cm)	80-95
Watermelon	Apr. 20-June 30	–	1½ (3.81)	80-100

**For longer harvest season, plant at intervals during suggested planting dates.

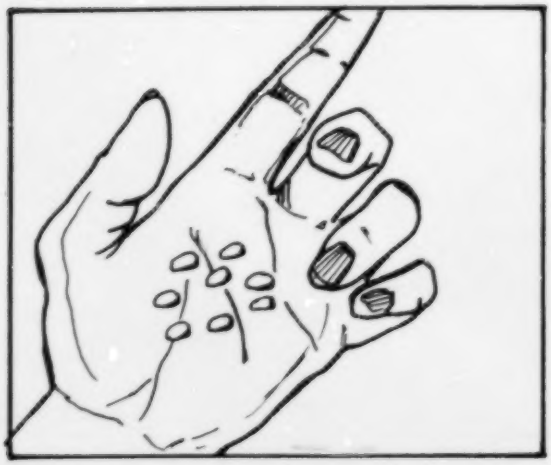
STEP 2 – Above is a planting chart. Choose the variety of seed you wish to plant from this list.

Check Point

On the Student Answer Sheet, answer the question in the blank provided.

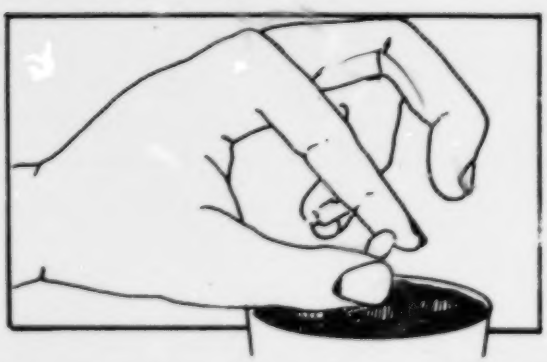
Instructional Objective VI

The student will plant two seeds in each cup.

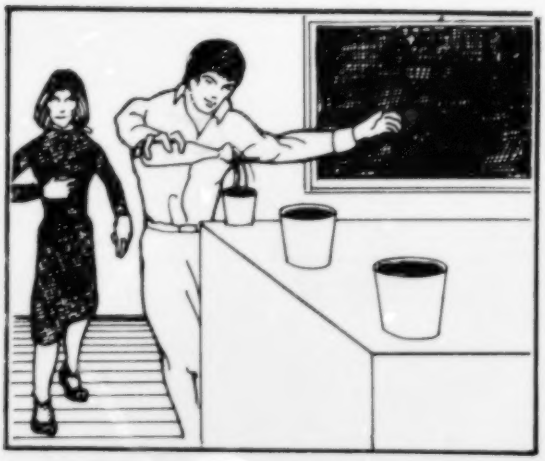


STEP 1 – Obtain eight seeds of your choice.

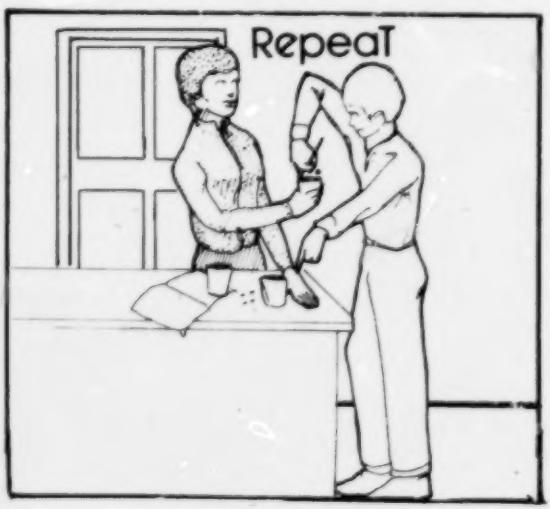
STEP 2 – Refer to the vegetable planting chart. Use a pencil to make two holes for correct planting depth.



STEP 3 – Place one seed in each hole and cover with soil.



STEP 4 – Moisten the soil until saturated, using the water sprinkler.



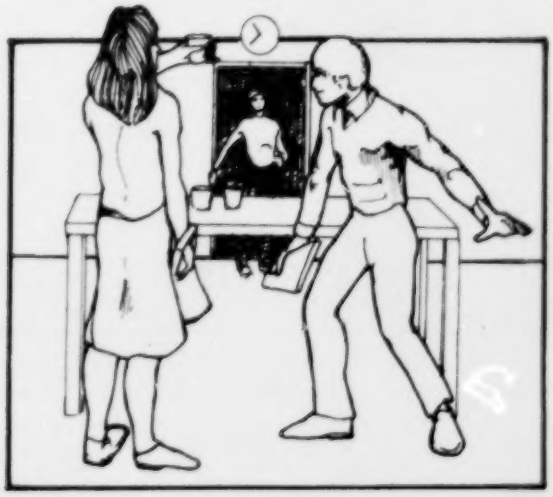
STEP 5 – Repeat steps 2 through 4 with cups 2, 3, and 4.

Check Point

Is your soil moist? Leave the cups in a dry, sunlit area.

Instructional Objective VII

The student will maintain the germinating (growing) plants.



STEP 1 – Check the moisture content of the soil at the beginning of each class period.

STEP 2 – Sprinkle water on the soil if dry.

STEP 3 – Record findings on Official Growth Chart.

Check Point

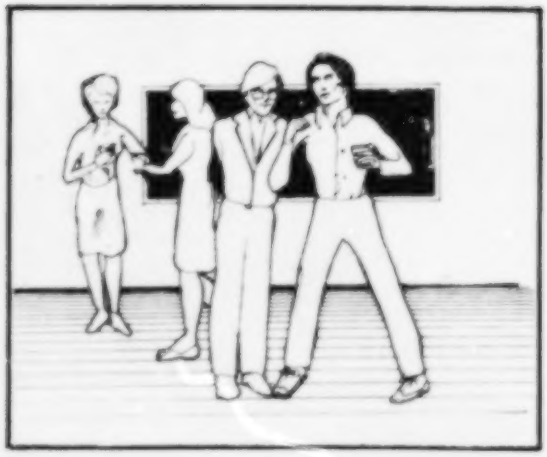
Have your instructor inspect your records every five days.

23

Instructional Objective VIII

After thirty-four (34) days, the class will determine what soil mixture worked best with particular seeds.

STEP 1 – Inform instructor of type seed planted when called upon.



STEP 2 – Rate from good to bad, cups 1 to 4.

STEP 3 – Record your fellow students' plant growth rate on a tally sheet.

Check Point

Which fertilizer was best for each crop listed on the Student Answer Sheet, Objective VIII?

402 VEGETABLE FARMING OCCUPATIONS

This group includes occupations concerned with growing and harvesting vegetable crops. Occupations concerned with growing and harvesting potatoes, sugar beets, and sugarcane are classified in Group 404. Occupations concerned with growing vegetables in a controlled environment, such as in greenhouses and sheds, are classified in Group 405.

402.131-010 SUPERVISOR, VEGETABLE FARMING (agric.) field supervisor.

Supervises and coordinates activities of workers engaged in planting, cultivating, and harvesting vegetable crops: Discusses seasonal crop growing activities with management to determine sequence of operations and supplies, machinery, and workforce needs. Assigns duties, such as tilling soil, planting, weeding, fertilizing, irrigating, harvesting, and maintaining machines, to subordinates, and specifies machines, tools, and supplies to be used. Observes workers to detect inefficient and unsafe work procedures and demonstrates approved procedures. Performs other duties as described under SUPERVISOR (any ind.). May supervise workers engaged in mechanical repairs. May requisition machinery parts and record purchase data.

402.161-010 FARMER, VEGETABLE (agric.) garden farmer; vegetable grower.

Raises vegetables: Determines kind and amount of crop to be grown, according to market conditions, weather, and size and location of farm. Selects and purchases seed, fertilizer, and farm machinery and arranges with buyers for sale of crop. Hires and directs farm workers engaged in planting, cultivating, and harvesting crop, such as beans, onions, and peas. Performs various duties of farm workers, depending on size and nature of farm, including setting up and operating farm machinery. May grow vegetables in greenhouse to produce out-of-season crops. May grow a variety of vegetables and be designated as TRUCK FARMER (agric.). May specialize in growing a single vegetable and be designated by the name of the vegetable, as ONION FARMER (agric.).

402.663-010 FARMWORKER, VEGETABLE (agric.) I

Drives and operates farm machinery to plant, cultivate, and harvest vegetables, such as peas, lettuce, tomatoes, and lima beans: Attaches farm implements, such as plow, planter, fertilizer applicator, and harvester, to tractor and drives tractor in fields to prepare soil and plant, fertilize, and harvest crops. Thins, hoes, and weeds row crops, using hand implements. Irrigates land to provide sufficient moisture for crop growth, using irrigation method appropriate to crop or locality. May mix spray solutions and spray crops. May supervise seasonal workers and keep time records of workers. May use horse-drawn equipment to plant, cultivate, and harvest crops. May adjust and maintain farm machinery. May be identified with crop raised.

402.687-010 FARMWORKER, VEGETABLE (agric.) II garden worker; laborer, vegetable farm; vegetable worker.

Plants, cultivates, and harvests vegetables, working as crewmember. Dumps seed into hopper of planter towed by tractor. Rides on planter and brushes debris from seed spouts that discharge seeds into plowed furrow. Plants roots and bulbs, using hoe or trowel. Covers plants with sheet or caps of treated cloth or paper to protect plants from weather. Weeds and thins blocks of plants, using hoe or spoon-shaped tool. Transplants seedlings, using hand transplanter or by placing seedlings in rotating planting wheel while riding on power-drawn transplanter. Sets bean poles and strings them with wire or twine. Closes and ties leaves over heads of cauliflower and other cabbage and cabbagelike plants. Picks, cuts, pulls, or lifts crops to harvest them. Ties vegetables in bunches and removes tops from root crops. Pitches vine crops into viner (pea or bean shelling machine), using pitchfork or electric fork and boom, and cleans up spilled vines. May participate in irrigation activities. May be

identified with work assigned, such as blocking, cutting, and stringing, or with crop raised, such as asparagus, beans, and celery.

402.687-014 HARVEST WORKER, VEGETABLE (agric.)

Harvests vegetables, such as cucumbers, onions, lettuce, and sweet corn, by hand or using knife, according to method appropriate for type of vegetable: Ascertains picking assignment from supervisor and places work aids, such as buckets and tie wires, in assigned area. Picks vegetable from plant, pulls vegetable from plant or soil, or cuts vegetable from stem or root. Puts vegetables in container or lays bunches of vegetables along row for collection. Carries containers or armloads of bunched vegetables to collection point. Loads vegetables on trucks or field conveyors. May tie vegetables into specified-size bunches, using wires or rubber bands. May cut top foliage from root vegetables, using knife. May wash vegetables. May be identified with tasks performed, such as picking, cutting, bunching, and washing; or with crop harvested, such as cucumbers, lettuce, onions, radishes, and sweet corn.